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May 24, 2019

Borough of Watchung

Watchung Municipal Building
15 Mountain Boulevard
Watchung, NJ 07069

Attn: Tom Aitkins

Re: Geotechnical Engineering Report
Proposed building
15 Mountain Boulevard
Watchung, NJ
JSC Job # 19-245
Purchase Order # 19-00530

Johnson Soils Company, Inc. (JSC) has been retained by **BOROUGH OF WATCHUNG** to perform a geotechnical investigation at the above referenced location for the proposed 9,000 to 9,500 square foot single story structure as per our proposal dated April 11, 2019. It includes JSC's findings, conclusions and recommendations related to the construction of the proposed building.

The site currently contains some 1 & 2 story buildings surrounds with asphalt and gravel parking areas. Along the south side of the property the area is wooded and elevations changes approximately elevation difference in the proposed area of 14 to 16 feet. Some construction debris piles can be found also in the area. The property is located on the south side of Mountain Boulevard and between Washington Drive and Somerset Street in Watchung, New Jersey. The approximate proposed building area is shown on the plan entitled "Boring Location Plan," which provided by the **BOROUGH OF WATCHUNG**.

INVESTIGATION

Four (4) borings were completed on May 20 & 21, 2019. The borings were advanced using truck-mounted drilling equipment by our sub-contractor, RV Drilling, Inc., in accordance with the procedures of the Standard Penetration Test (ASTM-1586). For this test, a standard split barrel sampler, which is two (2) inches outside diameter and one and three eighths ($1 \frac{3}{8}$) inches inside diameter, is advanced into the soil using a one hundred forty (140) pound weight hammer falling thirty (30) inches. Standard Penetration Tests were taken continuously from zero (0) to twelve (12) feet and at five (5) foot intervals until refusal. Two (2) rock cores were performed using and NX Core Barrel for five (5) feet into the rock.

The boring location plan and record sheet for each boring are attached to this report.

FINDINGS

The explorations for this study indicate that the site is underlain by relatively uniform subsurface conditions. The strata are listed below in order of increasing depth. Detailed descriptions of the subsurface conditions are shown on the individual logs of Borings, Plates 3A through 3D.

1. Misc. Fill: A layer of Misc. Fill was encountered from the surface in all borings to depths ranging from one to three (1-3) feet below the existing surface grade.
2. Sand & Silt (SM-ML): A layer of Sand & Silt was encountered below the Misc. Fill in Boring 1 to a depth of six (6) feet below the existing surface grade.
3. Silty Sand & Gravel (SM-GM): A layer of Silty Sand & Gravel was encountered below the Sand & Silt in Boring 1 and below the FILL in Borings 2, 3 & 4 to depths ranging from five foot three inches to twenty-five feet (5'3"-25') below the existing surface grade.

4. Fractured Basalt: A layer of Fractured Basalt was encountered below the Silty Sand & Gravel in Borings 3 & 4 to completions depth ranging from eleven to fifteen (11-15) feet below the existing surface grade.

Borings 2, 3 & 4 encountered refusal at 10'4", 9'3" & 5'3" respectively. The refusal depth is defined as the depth where no further penetration can be achieved with earth drilling and sampling procedures. Rock core drilling would be necessary to define whether the refusal depth is cobble, boulders or bedrock.

Rock Coring was performed in Borings 3 & 4 using an NX core barrel for a depth of five (5) feet into the Basalt.

Table 1

	B-1	B-2	B-3	B-4
Approx. Existing Ground Elevation	222	227	236	234
Depth to rock	-	10.33'	9.25'	5.25'
Approximate top of Basalt rock Elevation	-	216.67	226.75	228.75

** B-1 did not encounter any Basalt rock to a depth of 25 feet.

Ground water was only encountered in Boring 2 at a depth of nine feet six inches (9'6") below the existing surface grade at the time of the investigation. All other borings were dry at the time of the investigation. It should be noted that the water level conditions might vary due to variations in seasons, rainfall, temperature and other factors.

GENERAL SITE GEOLOGY

This site lies within the Piedmont Physiographic region, a plateau area that spans New Jersey in the Northern tip down in a Southwest direction to Alabama at its Southern end. The Newark Basin Makes up 95% of the Piedmont Physiographic Province and is composed of sedimentary material from the Mesozoic era deposited in a large basin caused by the rifting of Pangea. The bedrock is up to 11,000 feet of sedimentary and volcanic material from the Cenozoic, Mesozoic, Paleozoic, and Precambrian Eras.

The first layer of bedrock beneath this site is a part of the Passaic formation, which was formed during the Late Triassic to the Early Jurassic period (237-174 MYA). The bedrock consists of interbedded reddish-brown sandstone with siltstone, shaly siltstone, and shale. The sandstone ranges from fine to medium grained, it is thin to medium bedded, and contains mica. Middle and lower parts of unit contain interbedded olive-gray, dark-gray, or black siltstone, silty shale, shale, and less common argillite. Reddish-brown sandstone and pebbly sandstone are thin-to-thick-bedded, medium-to-coarse grained, planar to cross-bedded with local lensoidal interbeds of pebble conglomerate. Within the formation there are small variations that appear in layers within the classic Passaic formation of siltstone, silty mudstone, and shale. Two layers that occur include a layer with a sandstone, siltstone, and mudstone facies, and a layer with gray facies. The next layer is around 700 feet thick and composed of Orange Mountain Basalt, which is dark green-gray to black in color due to a composition of calcic plagioclase and clinopyroxene. Typically this unit consists of three major flows; the lower part of the upper flow is locally pillowed, with the upper part exhibiting pahoehoe flow structures. The middle flow is massive jointed to columnar jointed, while the lower flow usually has massive widely spaced curvilinear joints. The flow is usually pillowed at the top and where it comes into contact with the Passaic Formation below. This formation dates back to the Lower Jurassic Period (201-182 MYA).

The surficial geology in this region is composed of a layer typically less than ten feet of weathered basalt, a clayey silt, silty clay to clayey coarse sand with angular pebbles and cobbles of basalt. Most clasts have weathering rinds and include mixed clast and matrix sediment, fractured rock rubble, and saprolite that preserves the original rock structure

COMMENTS AND CONCLUSIONS

The proposed new building cannot be support on the misc. fill. We recommended removal of all fill and very soft Sand & Silt to the dense Silty Sand & Gravel. Conventional spread footings can be placed on the Silty Sand & Gravel.

At this time a proposed site plan is not available for this site. Therefore, the finished first floor elevation should be placed so minimal rock excavation can be obtained along with pedestrian access to the proposed building.

As seen in Table 1, rock was only encountered in 3 of the 4 borings. The highest rock elevation was encountered in Boring 4 at a depth of five feet three inches (5'3") at an estimated elevation of 228.75. It can also be noted that just east of Boring 4 a rock outcrop was seen in the field.

It is not recommended to place footings on both soil and rock, as this will cause differential settlement at the interface of the two materials. If rock is encountered during the footing excavation process a layer of crushed stone can be placed and used as a cushion.

See the recommendations section for more information.

Additional surface runoff that may enter the proposed excavations may be effectively controlled by sump pits placed within or adjacent to the proposed excavations. It should be noted that the water level conditions might vary due to variations in rainfall, temperature and other factors at the time of construction.

RECOMMENDATIONS

The following geotechnical design and construction recommendations are offered:

1. Foundation:

- a. Excavate down to the dense Silty Sand & Gravel.
 - i. If the existing grades are not changed, estimated depth to suitable material is three to six (3'-6') below the existing surface grade.
 - ii. If Basalt rock is encountered, a layer of crushed stone (3/4") can be placed as a cushion. Minimum depth of three (3) inches.
 - iii. All interior piers will also need to be excavated to the dense Silty Sand & Gravel
 - iv. A minimum of six (6) inches of crushed stone (3/4" or 1 1/2") a minimum of one (1) foot outside the proposed footing dimension to prevent the remolding of soils.
- b. Use an allowable bearing capacity of **four thousand (4,000) pounds per square foot (PSF)** on crushed stone on the dense Silty Sand & Gravel
- c. Maximum settlement is less than 1 in.
- d. Estimated differential settlement is less than 0.5 in.
- e. Minimum depth for frost protection is three feet six inches (3'6") below the final exterior grade.
- f. All concrete footings should be kept dry a minimum of forty-eight (48) hours after the footings are poured for proper curing.
- g. Concrete blankets (or equivalent) are required if the temperature drops below thirty-two (32) degrees to prevent the concrete from freezing.

2. Slab on Grade:

- a. Remove all topsoil or other deleterious materials.
- b. Proof roll area with a minimum of four (4) passes of heavy vibratory compactor with a minimum static drum weight of 12,000 pounds or equal.
 - i. Any areas which are observed to be soft or unstable should be removed and replaced with controlled Fill and compacted as per recommendations # 7 and #8.
- c. Where compaction is performed, use a Modulus of Subgrade Reaction (k) of two hundred (200) pounds per cubic inch (pci) for slab design.
- d. A minimum of six (6) inches of $\frac{3}{4}$ " crushed stone should be placed under all slabs on grades.
- e. A 6 mil. vapor barrier should be placed on the crushed stone.

3. Parking and Driveway Areas:

- a. Proof roll area with a minimum of four (4) passes with a heavy vibratory compactor with a minimum static drum weight of 12,000 pounds or equal
- b. Any areas, which are observed to be soft or unstable, should be removed and replaced with controlled Fill and compacted as per recommendations #7 and #8.
- c. Subbase: Quarry Process Stone: 6"
- d. Base Course: I-2 – 4"
- e. Surface Course: I-5 – 2"

4. Soil Classification "C" as per OSHA 1926 Subpart P App A with maximum allowable slopes (H:V) of 1 $\frac{1}{2}$:1 as per OSHA 1926 Subpart P App B Table B-1.

- a. This is for short-term maximum allowable slopes less than twelve (12) feet.
- b. Sloping or benching for excavations greater than twenty (20) feet deep shall be designed by a Professional Engineer licensed in the State of New Jersey.

5. The Seismic Site Classification is "C" in terms of the International Building Code (IBC).
The profile is not considered to be susceptible to liquefaction.

- | | |
|---------------------|----------------------|
| a. $S_S = 0.259g$ | d. $S_{M1} = 0.118g$ |
| b. $S_1 = 0.070g$ | e. $S_{DS} = 0.207g$ |
| c. $S_{MS} = 0.11g$ | f. $S_{D1} = 0.079g$ |

6. Retaining Wall Design Information:

- | | |
|-------------------------------|---------------------------------|
| a. Sand & Silt (SM-ML): | b. Silty Sand & Gravel (SM-GM): |
| i. $\gamma = 115 \text{ PCF}$ | i. $\gamma = 130 \text{ PCF}$ |
| ii. $\phi = 28^\circ$ | ii. $\phi = 32^\circ$ |
| iii. $C = 25 \text{ PSF}$ | iii. $C = 0 \text{ PSF}$ |

7. Types of Controlled FILL:

- a. The existing onsite Sand & Silt (SM-ML) is not recommend. This material can be extremely difficult to reuse and compact.
- b. The onsite Silty Sand & Gravel (SM-GM) can be reused as backfill or controlled Fill when used +/- 2% moisture content and approved by a geotechnical engineer at the time of use.
- c. Contractor shall be careful to keep excavated material dry as possible with tarps or other protection.
- d. Other Controlled Fill Options:
 - i. Crushed Stone at $\frac{3}{4}$ " or $1 \frac{1}{2}$ " size with no fines.
 - ii. Sand and Gravel with less than 20% passing the #200 sieve.
 - iii. Quarry Process Stone (QP) with less than 20% passing the #200 sieve.

8. Controlled and Compacted Fill Requirements:

- a. A geotechnical engineer licensed in the state of New Jersey to inspect all earthwork operations.
- b. The contractor and/or owner shall notify the geotechnical engineer in writing a minimum of five (5) days prior to the start of all work on the project. The notification shall include all sources of Fill, equipment to be used, the estimated dates of the work and the proposed onsite supervisor.
- c. All misc. Fill and Topsoil shall be graded prior to the start of all earthwork operations.
- d. All Fill areas shall be proof rolled prior to the placement of any new Fill. All proof rolling shall be performed in the presence of the geotechnical engineer. If soft areas are found during the proof rolling process, the area shall be removed and replaced with compacted, controlled Fill as per the direction of the geotechnical engineer.
- e. Any proposed Fill area shall be leveled before placement of any Fill. The area shall be free from ruts, hummocks or other uneven surfaces that would prevent uniform compaction.
- f. Use any of the material stated in the types of controlled Fill section or other material approved by the geotechnical engineer.
- g. A fifty pound (50-lb) bag of material shall be submitted to the geotechnical engineer for approval and testing a minimum of five (5) days prior to the start of work. No Fill material shall be placed until the geotechnical engineer has approved the material for use in the project.
- h. All controlled Fill should be placed in horizontal layers of eight to twelve (8-12) inches in loose thickness and be uniformly compacted to achieve a density of at least ninety-five (95) percent of the maximum dry density as determined by in the laboratory when tested in accordance with the most recent ASTM D1557 Standard.
- i. Backfill within confined areas should be placed in layers of six to eight (6-8) inches in loose thickness and compacted to the same 95% of maximum dry density using portable compaction equipment.

- j. No Fill material shall be placed, spread or compacted when the ground or Fill is frozen, thawing or during unfavorable weather conditions. When work is interrupted by heavy rain or frost, operations shall not be resumed unless the moisture content and density of the Fill are acceptable to the geotechnical engineer.
 - k. A sufficient number of passes shall be approved by the geotechnical engineer in order to achieve the acceptable specified density above. A minimum of three (3) passes of the approved compactor shall be required over all areas of each lift.
 - l. Field density tests shall be made by the geotechnical engineer to determine the in-place field density in each layer placed. No Fill shall be placed over any layer that has not been previously approved by the geotechnical engineer. Should any of the tests find insufficient density, then additional compaction will be required until the required density is obtained.
9. The following construction tasks should be inspected by a geotechnical engineer using appropriate laboratory and field testing support:
- a. Bottom of excavated area for all footings to be excavated into dense Silty Sand & Gravel.
 - i. If excavation is to the rock, a crushed stone cushion is recommended.
 - b. All types of controlled Fill soils to be used in footings and slab areas.
 - c. Compaction of all controlled Fill for footings and slab areas.

Geotechnical Engineering Report
Proposed Library
15 Mountain Boulevard
Watchung, NJ
JSC Job # 19-245
Purchase Order # 19-00530

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The recommendations above are based on the data obtained from soil borings performed at the indicated specific locations and from other identified information. This report does not reflect any variations which may occur across the site apart from the borings. The nature and extent of such variations may not become evident until construction. If variations appear evident, it will be necessary to re-evaluate the recommendations of this report.

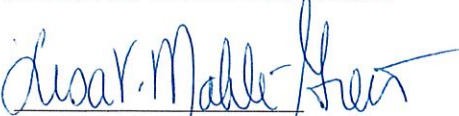
This report has been prepared for the specific application to the project noted. In the event that there are changes in the nature, design or locations of the proposed structures, the conclusions and recommendations contained herein are not valid unless the changes are reviewed and the recommendations modified in writing by JSC.

The information and opinions rendered in our report are exclusively for use by **BOROUGH OF WATCHUNG** and JSC will not distribute or publish this report without written consent except as required by law or court order. The information and opinions expressed in this report are given in response to a limited assignment and should be considered and implemented only in light of that assignment. The services provided by JSC in completing this project were consistent with normal standards of the profession. No warranty, expressed or implied, is made.

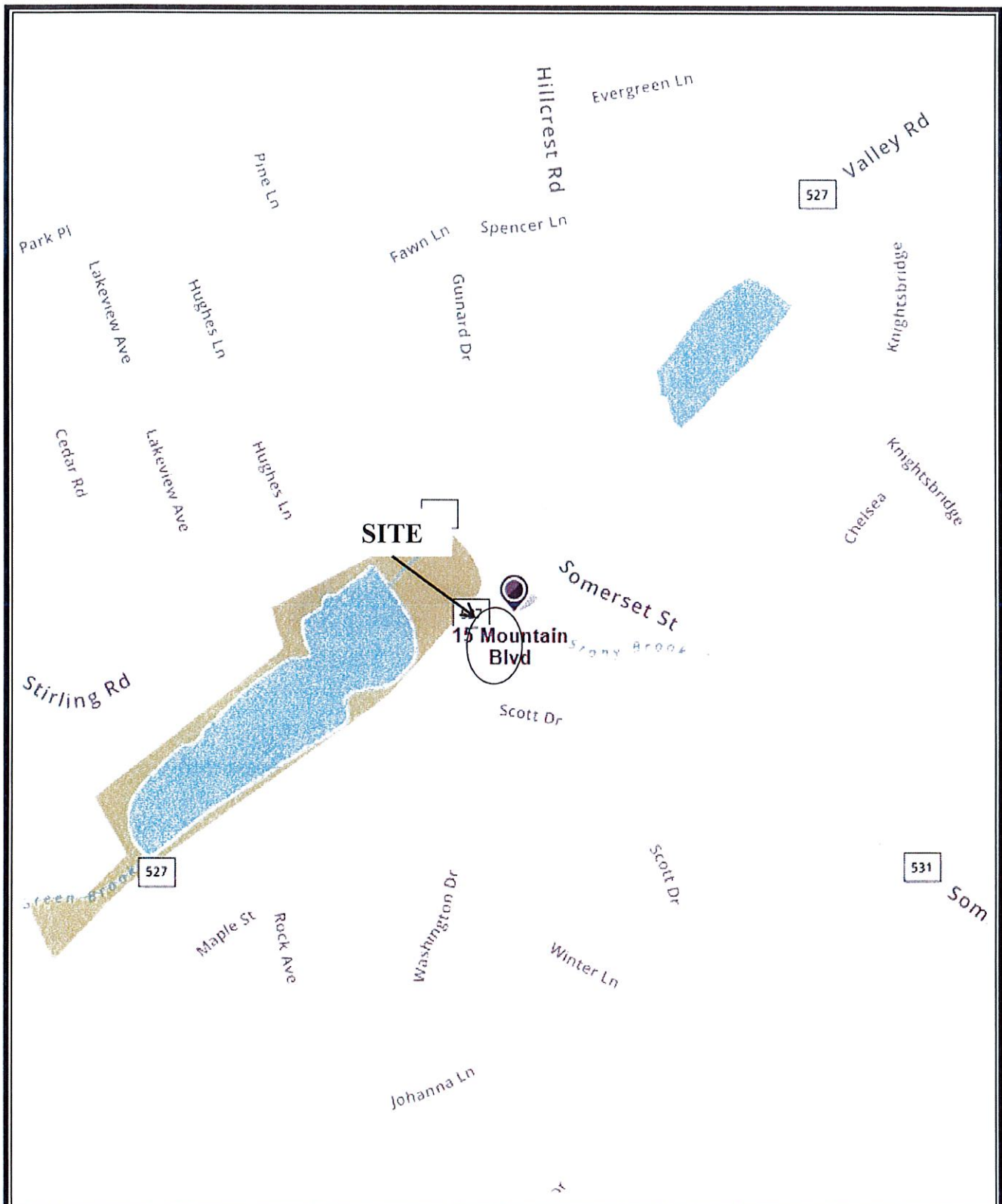
The following Plates are attached to this report:

Plate 1 -	Site Location Map
Plate 2 -	Boring Location Plan
Plate 3A through 3d -	Logs of Borings
Plate 4 -	Unified Soil Classification System
Plate 5A & 5B -	Photos of rock cores

Very truly yours,
JOHNSON SOILS COMPANY


Lisa V. Mahle-Greco, P.E.
Engineering Manager
NJ Lic. No. 43197



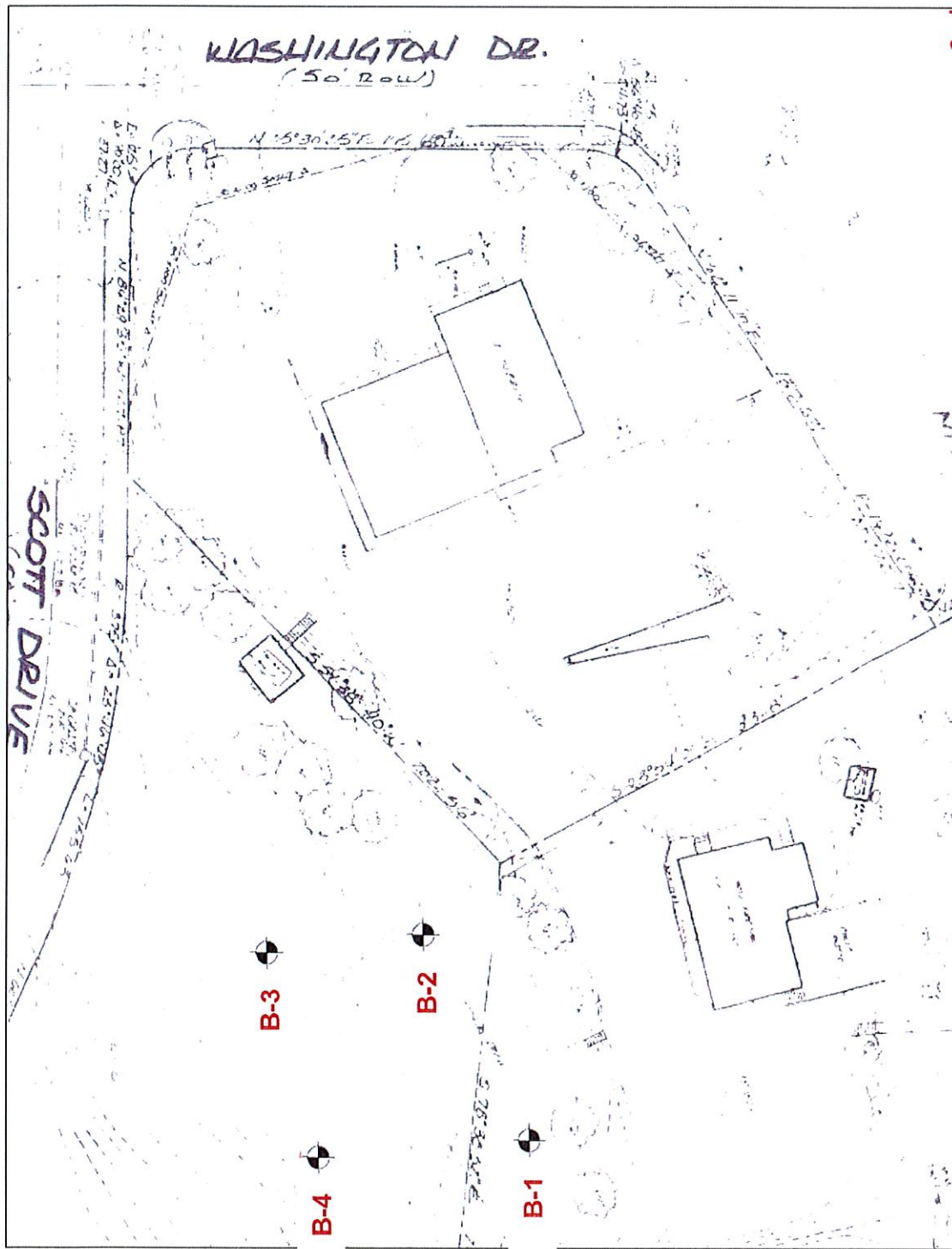


Site Location Plan

JSC #19-245

Proposed Library
15 Mountain Blvd., Watchung, NJ

PLATE 1



Scale: N.T.S.



Boring Location Plan

JSC #19-245

Proposed Library, 15 Mountain Blvd.
Watchung, NJ

PLATE 2



**LOG OF BORING
B-1**

Sheet 1 of 1
JSC Job #: 19-245
Completed: 5/20/ 2019
Water Level: Dry

Depth (Feet)	Sample #	Depth (Feet)	Sample/Spoon Blows/6"	Symbol USCS	Depth	Description
0	1	0-2	3-9-7-7		0-2'	FILL - Sand, Cinders, Gravel, Topsoil
-						
-	2	2-4	7-8-8-8	SM-ML	2'-6'	Yellow brown fine Sand & Silt, trace Gravel (moist, medium dense)
-						
-	3	4-6	6-7-10-15			
5						
-	4	6-8	10-11-15-12	SM-GM	6'-25'	Brown fine to coarse Sand & Gravel, little Silt (moist, dense) <



**LOG OF BORING
B-2**

Sheet 1 of 1
JSC Job #: 19-245
Completed: 5/20/ 2019
Water Level: 9'6"

Depth (Feet)	Sample #	Depth (Feet)	Sample/Spoon Blows/6"	Symbol USCS	Depth	Description
0	1	0-2	7-7-10-8		0-3'	FILL - Sand, Gravel, Topsoil
-	2	2-4	5-4-5-8			
-	3	4-6	11-25-44-24			
5	4	6-8	20-100/5"	SM-GM	3'-10'4"	Brown fine to coarse Sand & Gravel, little Silt trace Cobbles & Boulders (moist, medium dense) - grading to dense @ 4' - grading to very dense @5'
-	5	8-10	71-100/5"			
-	6	10-12	100/4"			
10						
-						
-						
-						
15						
-						
-						
-						
20						
-						
-						
-						
25						
-						
-						
-						
30						
-						
-						
-						
35						

Remarks: Boring B-2 completed @ 10'4" on 5/21/2019

Client: Borough of Watchung

☒ Hollow Stem Auger

Site: Proposed Library
15 Mountain Blvd., Watchung, NJ

☐ Portable

Driller: RV Drilling

☐ Mud Rotary

PLATE 3B



**LOG OF BORING
B-3**

Sheet 1 of 1
JSC Job #: 19-245
Completed: 5/20/ 2019
Water Level: Dry

Depth (Feet)	Sample #	Depth (Feet)	Sample/Spoon Blows/6"	Symbol USCS	Depth	Description
0	1	0-2	4-5-6-9		0-1'	FILL - Sand, Cinders, Gravel, Topsoil
-	2	2-4	6-5-10-15			Brown fine to coarse Sand & Gravel, little Silt trace Cobbles & Boulders
-	3	4-6	18-14-25-16			
-	4	6-8	15-15-19-90			
5	5	8-10	87-51-23-100/3"	SM-GM	1'-9'3"	
-						
10	R-1	10-15			10'-15'	- Augered to 10' Highly fractured Basalt Recovery = 100% RQD = 0%
-						
-						
-						
-						
20						
-						
-						
-						
25						
-						
-						
-						
30						
-						
-						
-						
35						
Remarks: Boring B-3 refusal @ 9'9" on 5/21/2019						
Client: Borough of Watchung				<input checked="checked" type="checkbox"/> X Hollow Stem Auger		
Site: Proposed Library 15 Mountain Blvd., Watchung, NJ				<input type="checkbox"/> Portable		
Driller: RV Drilling				<input type="checkbox"/> Mud Rotary		
PLATE 3C						



**LOG OF BORING
B-4**

Sheet 1 of 1
JSC Job #: 19-245
Completed: 5/20/ 2019
Water Level: Dry

Depth (Feet)	Sample #	Depth (Feet)	Sample/Spoon Blows/6"	Symbol USCS	Depth	Description
0	1	0-2	2-2-3-5		0-1'	FILL - Sand, Cinders, Gravel, Topsoil
-						
-	2	2-4	7-13-18-41	SM-GM	1'-5'3"	Brown fine to coarse Sand & Gravel, little Silt trace Cobbles & Boulders
-						
-						
-	3	4-6	35-42-100/3"			- Augered to 6'
5						
-						
-	R-1	6'-11'			6'-11'	Highly fractured Basalt Recovery = 100% RQD = 15%
-						
10						
-						
-						
-						
-						
15						
-						
-						
-						
-						
20						
-						
-						
-						
-						
25						
-						
-						
-						
-						
30						
-						
-						
-						
-						
35						
Remarks:						Boring B-4 refusal @ 5'3" on 5/20/2019
Client: Borough of Watchung						<input checked="" type="checkbox"/> Hollow Stem Auger
Site: Proposed Library 15 Mountain Blvd., Watchung, NJ						<input type="checkbox"/> Portable
Driller: RV Drilling						<input type="checkbox"/> Mud Rotary
						PLATE 3D



66 Glen Avenue
Glen Rock, NJ 07452
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Email: johnsonsoils@gmail.com

UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COURSE FRACTION <u>RETAINED</u> ON NO. 4 SIEVE	CLEAN SAND (LITTLE OR NO FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS <u>LARGER</u> THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY-SANDS LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SP	POORLY-GRADED SANDS, GRAVELLY SANDS LITTLE OR NO FINES
	MORE THAN 50% OF COURSE FRACTION <u>PASSING</u> NO.4 SIEVE	CLEAN SAND (LITTLE OR NO FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT <u>LESS</u> THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
		LIQUID LIMIT <u>GREATER</u> THAN 50	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDS CLAYS, SILTY CLAYS, LEAN CLAYS
MORE THAN 50% OF MATERIAL IS <u>SMALLER</u> THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT <u>GREATER</u> THAN 50	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
		LIQUID LIMIT <u>GREATER</u> THAN 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
HIGHLY ORGANIC SOILS	SILTS AND CLAYS	LIQUID LIMIT <u>GREATER</u> THAN 50	CH	INORGANIC CLAYS OF HIGH PLASTICITY FAT CLAYS
		LIQUID LIMIT <u>GREATER</u> THAN 50	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
		LIQUID LIMIT <u>GREATER</u> THAN 50	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.

GRADUATION*

COMPACTNESS*
SAND AND/OR GRAVEL

CONSISTENCY*
CLAY AND/OR SILT

% FINER BY WEIGHT

RELATIVE DENSITY

RANGE OF SHEARING STRENGTH
IN POUND PER SQUARE FOOT

TRACE.....0% TO 10%
LITTLE.....10% TO 20%
SOME.....20% TO 35%
AND.....35% TO 50%

LOOSE.....0% TO 40%
MEDIUM DENSE.....40% TO 70%
DENSE.....70% TO 90%
VERY DENSE.....90% TO 100%

VERY SOFT.....LESS THAN 250
SOFT.....250 TO 500
MEDIUM.....500 TO 1000
STIFF.....1000 TO 2000
VERY STIFF.....2000 TO 4000
HARD.....GREATER THAN 4000

VALUES ARE FROM LABORATORY OR FIELD TEST DATA WHERE APPLICABLE WHEN NO TESTING WAS PERFORMED, VALUES ARE ESTIMATED.



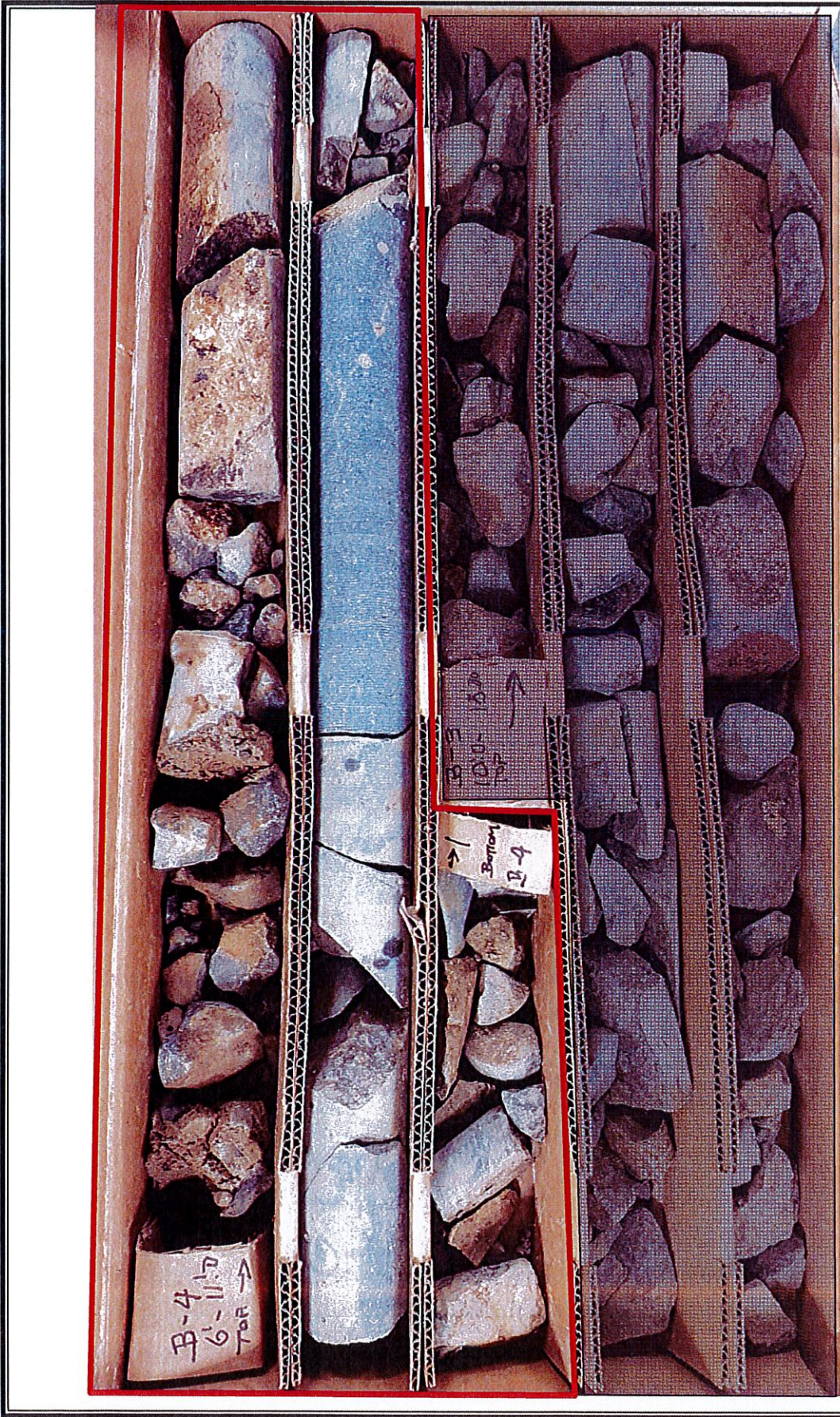
Rock Core – Boring B-3

Run 1 (10'-15'): RQD = 0% (VERY POOR)

JSC #19-245

Proposed Library, 15 Mountain Blvd., Watchung, NJ

PLATE 5A



Rock Core – Boring B-4
Run 1 (6'-11'): RQD = 15% (VERY POOR)

JSC #19-245

Proposed Library, 15 Mountain Blvd., Watchung, NJ

PLATE 5B